Space Weather Technical Forecast

Issued on Tuesday, 17 May 2022 at 01:24 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of R1-R2 radio blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate over the past 24 hours, with a M2.4 flare at 16/1327 UTC from an active region on the northeast limb. There are eight numbered sunspots on the visible disc. AR3007 Dsi/Beta continues as the largest and most complex area, with some decrease in growth observed, with all other visible regions remaining relatively small and stable. Some further growth has been observed in AR3014 Dao/Beta in the northeast with the intermediate spots growing quite rapidly and a delta configuration is now evident. There remain numerous filaments on the disc however no Earth-directed Coronal Mass Ejections (CMEs) have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by ACE and DSCOVR at L1, was elevated between 500 and 600km/s. The density of the wind was near to slightly above average. The Interplanetary Magnetic Field (IMF) Bt, was Weak to Moderate, ranging between 5nT to 10nT. The north-south component showed fluctuating periods of north/south orientation, between +8 and -7nT, but was more frequently positive (northward) orientated. The phi angle was predominantly positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 1 to 3).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) has been at Background levels through the last 24 hours. The high energy electron flux (greater than 2 MeV) has remained mostly at background levels, with the corresponding electron fluence well below the Active (1e8 integrated pfu) threshold on a current level trend. Observed fluence at 17/0000 UTC was 1.32e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to remain at Low to Moderate levels, with M-class flares becoming slightly more likely over the next few days owing to potentially further active regions rotating around the northeast limb, and a Slight Chance (5%) of an X-class flare.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Current elevated solar winds are expected to decline slowly over the next couple of days before the next notable enhancement from the arrival of the high speed stream (HSS) related to CH82/+. This is currently likely around day 2 (18th), however this is a low confidence forecast. Geomagnetic activity is currently Quiet with isolated Unsettled spells, before then becoming Unsettled to Active from coronal hole HSS arrival, most likely later on day 2 (18th).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to be at background levels during this period, although there is a very slight risk of an S1 or greater event due to AR3007. The high energy electron flux (greater than 2 MeV) is

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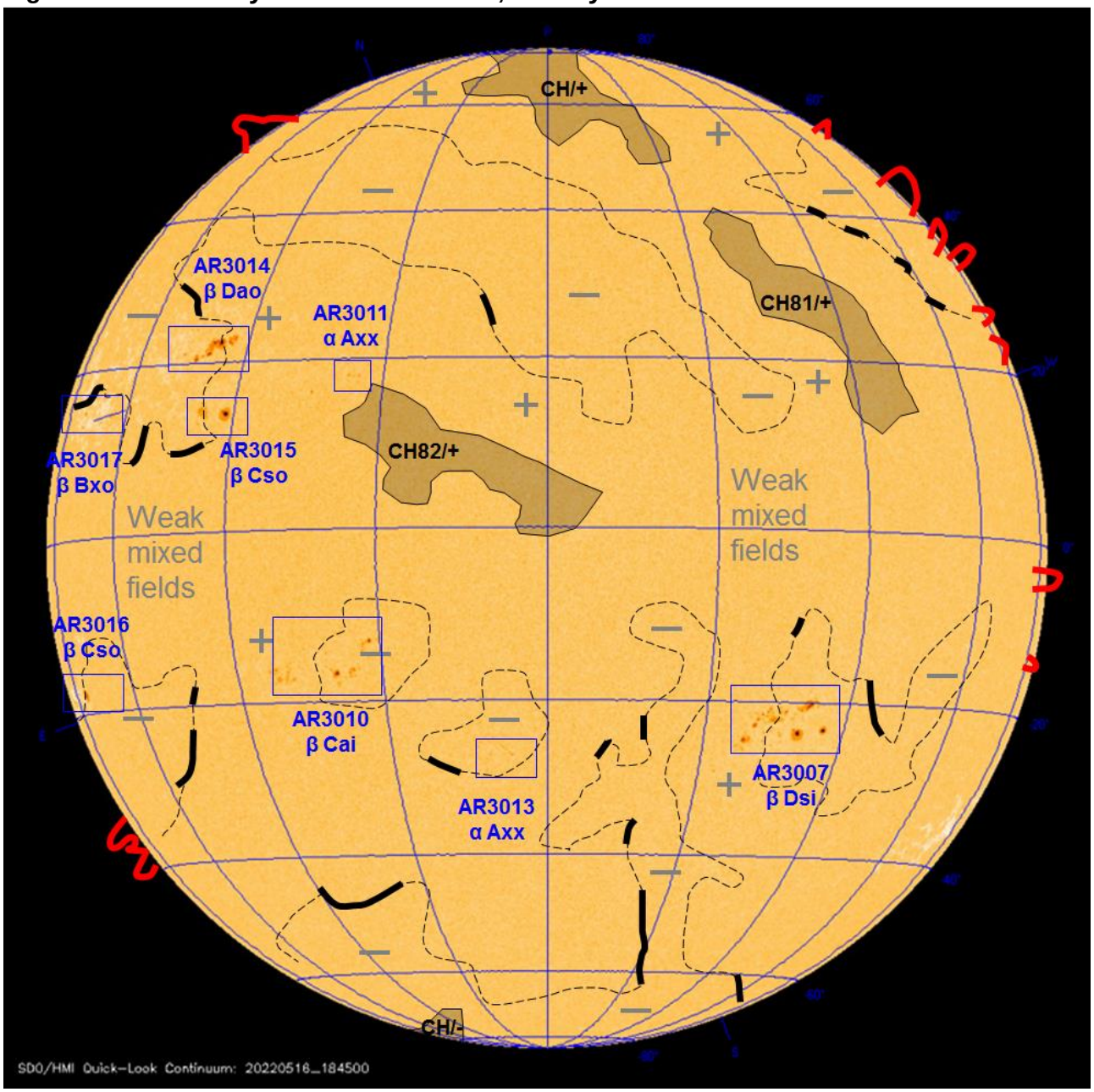
forecast to remain at Normal Background to Moderate levels at first, but may rise over the next few days, with an increased chance of the diurnal peak reaching High levels, mainly by day 3 (19th) due to any fast wind arrival. The 24-hour electron fluence is expected to remain below the Active (1e8 integrated pfu) threshold during the forecast period.

Figure 1. Solar Analysis Valid 2000UTC, 16 May 2022.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

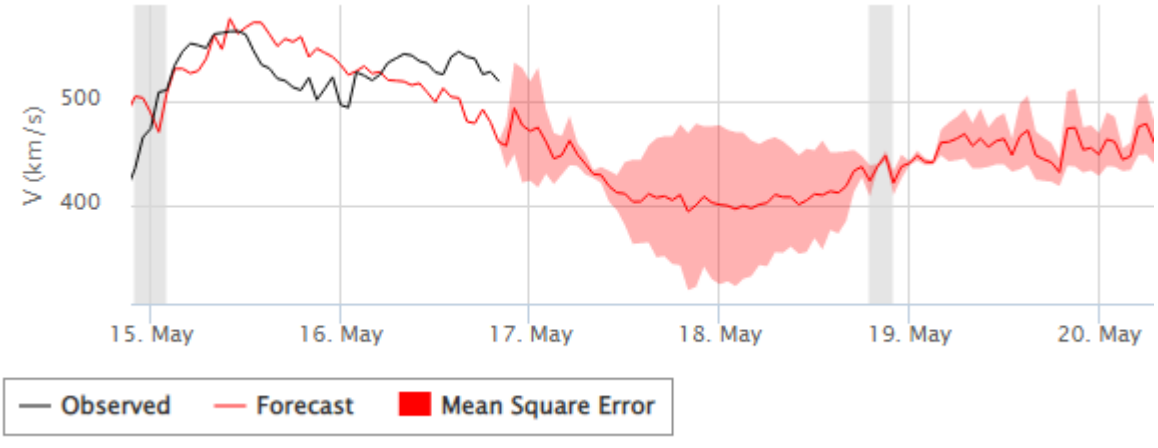
There are no Earth-bound Coronal Mass Ejections (CMEs)
Solar winds are currently Elevated with Earth moving through the high speed stream of positive polarity CH81. These elevated winds are expected to gradually decline over the next couple of days, prior to the arrival of the fast wind from CH82/+. This is an equatorial hole, and significantly more westward extended than on the previous rotation. Solar wind persistence would suggest a weak arrival on day 3 (19th), whilst enlil is currently indicating arrival either late day 1 or day 2 (17th or 18th). Arrival late 18th or during the 19th is currently favoured, but with low confidence. Geomagnetic activity is currently Quiet with isolated Unsettled spells. Arrival of fast winds of coronal hole 82 may then increase activity to Unsettled to Active and this is most likely later on day 2 (18t) or early on day 3 (19th).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	20	20	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: Met Office Solar Winds Prediction Model (SWPM) with the next HSS



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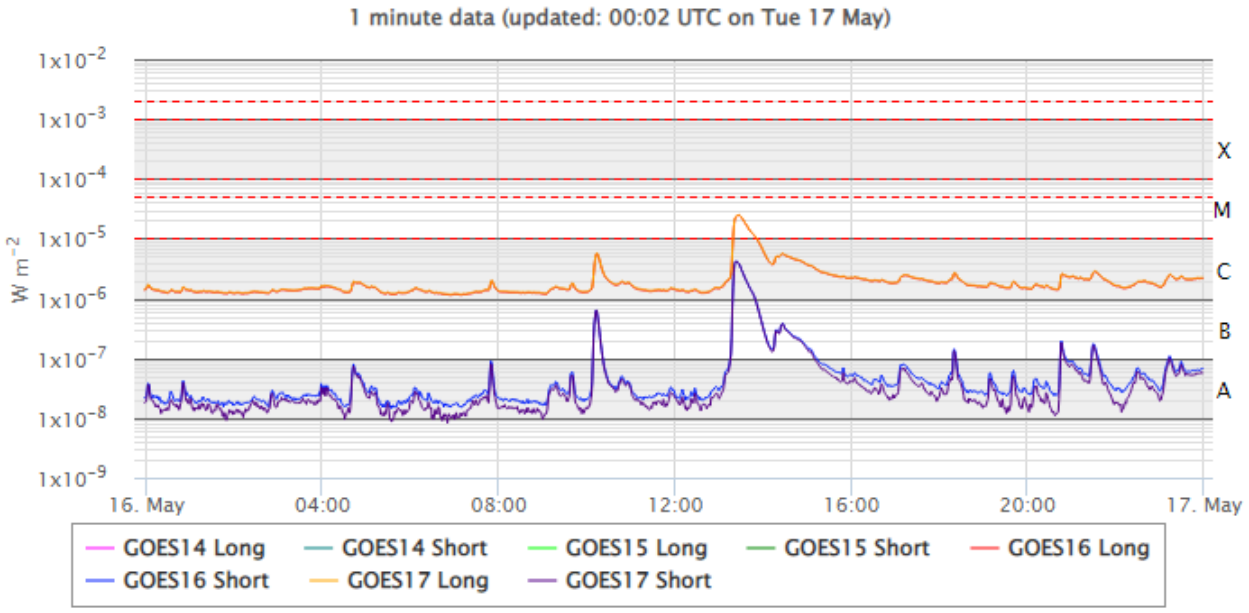
Radio Blackouts - X-Ray Flares:
Solar Activity is currently Moderate with a recent M2.4 flare from a new sunspot regions in the northeast disc, with eight numbered sunspot regions.
The largest region, and likely source of notable flaring is AR3007 Dsi/Beta, however this region currently appears stable with a relatively simple bipolar structure. Further regions of note include AR3010 Cai/Beta, AR3014 Dao/Beta and AR3015 Cso/Beta, however AR3014 is the region displaying most growth with the intermediate spots developing and shooing signs of a delta configuration. Remaining regions appear relatively stable. Further regions are also likely to rotate onto the disc during the period, with looping visible on STEREO A-euvi imagery beyond the west limb.
Low activity is expected to persist, with a daily (40-50%) chance of isolated M-flares potentially increasing activity to Moderate. This risk perhaps increasing later in the period, with any far-sided regions that rotate onto the disc. There is a very slight chance of X-flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	40	40	50	50
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: X-ray flux at GEO showing a few C-class flares and the isolated M-class flare observed.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is at background levels and is expected to remain at that level throughout the period. However, there is a slight chance of an S1 or greater event during the forecast period, primarily due to AR3007 as it transits westwards towards the western limb of the visible disc.

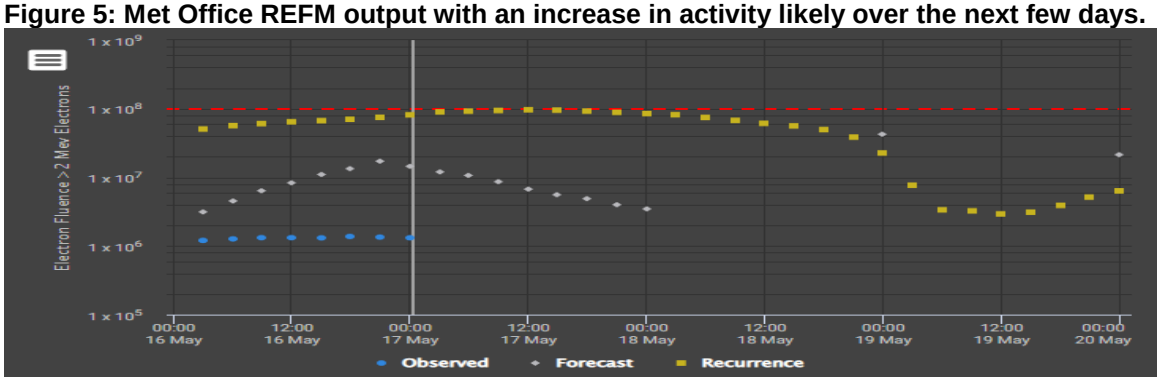
Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	5	5	5	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2 MeV) as measured by GOES-16 at GEO is currently at background levels, but may rise to Moderate levels over the next few days due to fast wind influence from CH81/+ . Any potential enhancement to the solar wind environment from CH82, most likely by day 3 (19th), could then increase flux levels to Moderate to High by day 4 (20th). The corresponding electron fluence is therefore expected to show an upward trend through the period, however on balance will most likely continue below the Active (1e8 integrated pfu) threshold. This is reflected by current REFM output and in the probabilities table above.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	5	10
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 5: Met Office REFM output with an increase in activity likely over the next few days.



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